Space Weather Technical Forecast

Issued on Friday, 25 March 2022 at 12:43 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance R1/R2 Radio Blackouts throughout. Chance G1/Minor Storms day 2 and 3 (26th and 27th).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate with an M 1.46 flare at 25/0526 UTC from AR2974 Cao/Beta in the southeast. AR2975 Csi/Beta and 2976 in the northeast are quite close together and will be monitored for further development. 2976 is quite a large Ehi/ Beta region and has produced some C-flares. The M flare appears to have produced a CME and will be analysed for any Earth-directed component once more images come in. No other Earth-directed CMEs were observed in the last 24 hours.

Solar Wind / Geomagnetic Activity: The solar wind as observed by DSCOVR at L1 declined from around 550 km/s to near 430 km/s at the end of the period, likely due to waning influence from CH67. The density was around average throughout. The strength of the interplanetary magnetic field (IMF), Bt, was weak below 5 nT, with the north south component Bz ranging -3 nT to +4 nT. The phi angle was predominately positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 1-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) measured at GOES 16 was at Background levels. The high energy electron flux (greater than 2MeV) has been at Normal Background levels, and the 24-hour integrated electron fluence was steady, below the Active (1e8 integrated pfu) threshold. Observed fluence at 25/0001 UTC was 1.05e6 integrated pfu.

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Met Office Space Weather Technical Forecast

Four-Day Space Weather Forecast Summary

Solar Activity: Low solar activity is expected, with further C-flares expected from AR2976 and AR2975 in the northeast disc. There is a chance (30%) of increasing to moderate with the occurrence of any further M-flares (R1/R2 Radio blackouts).

Solar Wind / Geomagnetic Activity: A CME from the M1.46 flare at 25/0526 UTC will be analysed for any Earth-directed component once more imagery becomes available, beyond that there are no other Earth-directed CMEs in the forecast. Current slightly-elevated solar winds are forecast to decline on day 1 and early day 2 (25th-26th) as the High Speed Stream of CH67 eases, before the arrival of a further High Speed Stream from CH69 later day 2 (26th). Solar winds are likely to reach 500-600 km/s, before easing again later day 3 and day 4 (27th and 28th). Quiet to Unsettled geomagnetic activity at first is expected to become Active with a chance of G1/Minor Storm intervals later day 2 and day 3 (26th/27th), before easing to Quiet to Unsettled day 4 (28th).

Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to be at Background levels throughout the forecast period, with only a very slight chance of rising above background levels from the one large sunspot on the disc. The high energy (greater than 2 MeV) electron flux is currently at background, with a chance of rising to Moderate levels through days 2-4, (26-28th) response to the fast wind of CH69 from late day 2 onward (26th). The associated 24 hr fluence will likely persist below the Active (1e8 integrated pfu) threshold but with a chance of rising above by the end of day 4 (28th).

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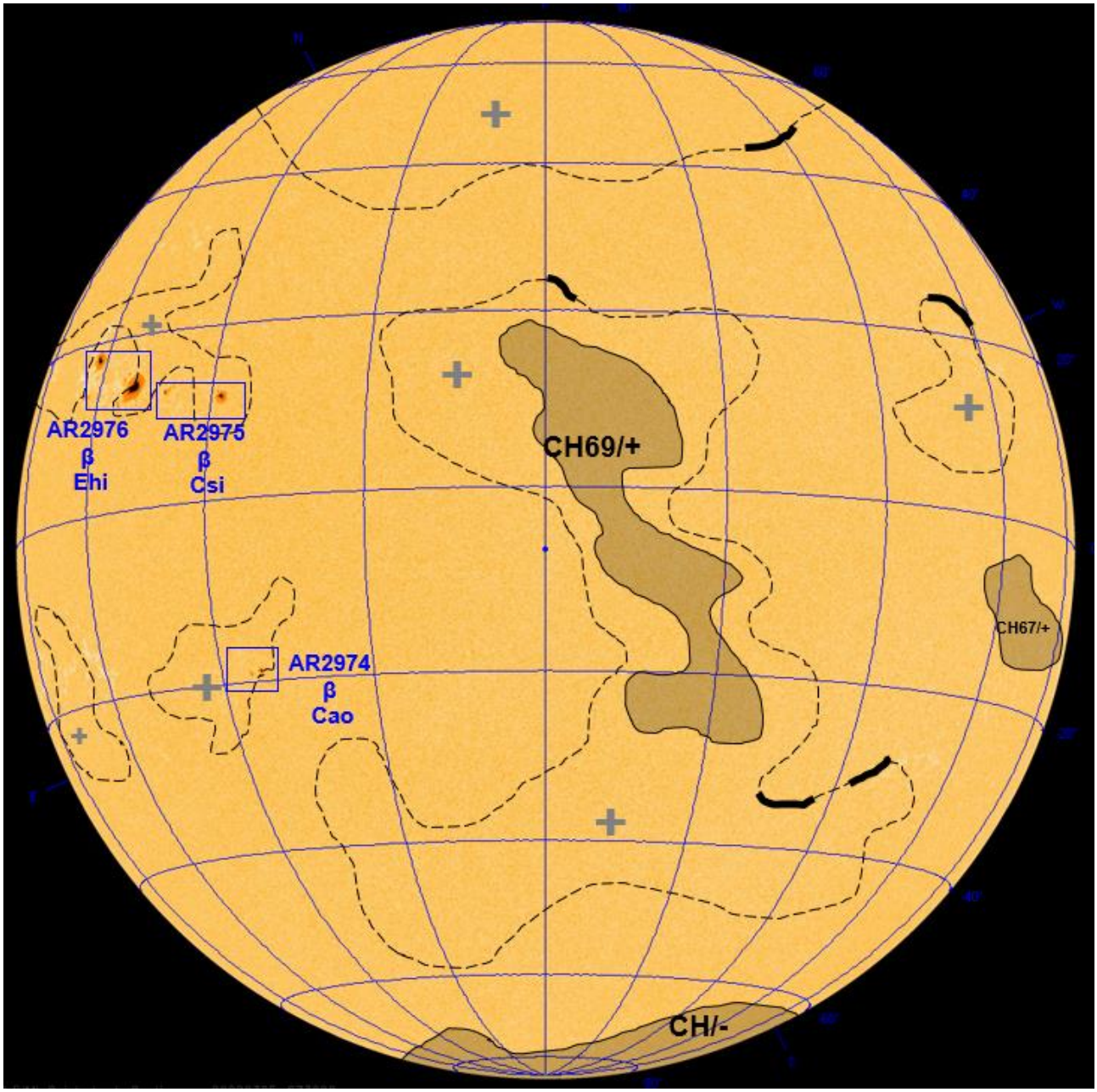
Figure 1. Solar Analysis Valid 25/0800UTC.



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Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

A CME from the M1.46 flare at 25/0526UTC will be analysed for any Earth-directed component once more imagery becomes available, beyond that there are no other Earth-directed CMEs in the forecast.

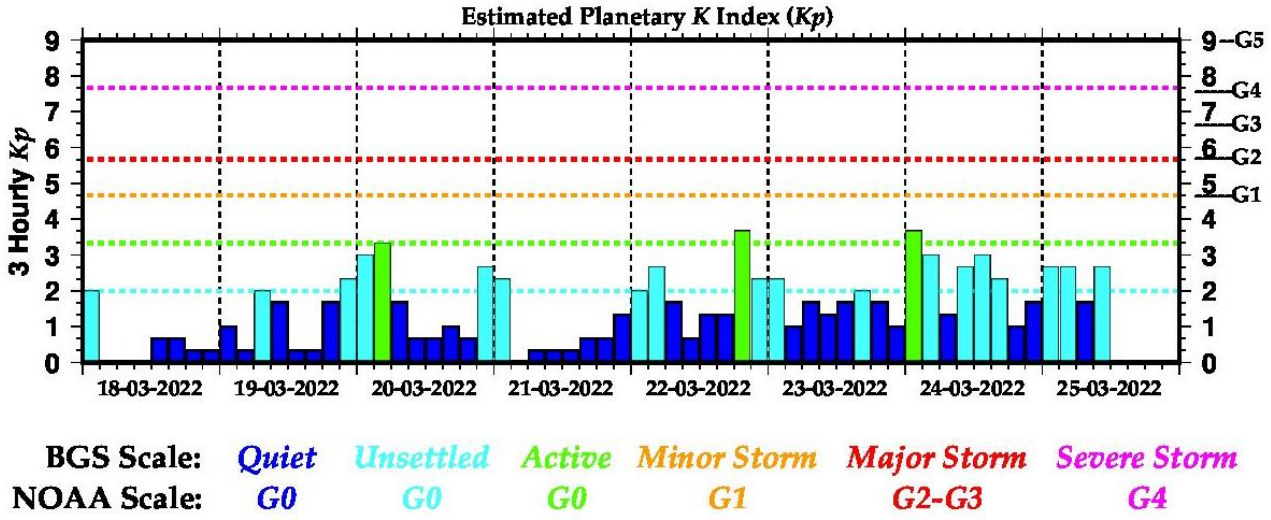
Current fast winds from CH67 are forecast to gradually decline day 1 and much of day 2 (25th and 26th) before the arrival of the next region of fast winds from CH69. This is an equator spanning hole, and recurrent from the previous rotation, where persistence would suggest arrival on the 27th with peak speeds just over 500 km/s. However, observations from STEREO A, indicate an earlier arrival on day 2 (26th), with peak speeds potentially in excess of 600 km/s. This is considered the more likely occurrence although winds perhaps peaking just below 600 km/s

Mainly Quiet geomagnetic activity at first, with a slight chance of Unsettled spells is forecast to become Active with a chance of G1/Minor Geomagnetic storms on day 2 (26th), perhaps extending into day 3 (27th). Mainly Quiet to Unsettled conditions then likely returning by day 4 (28th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	40	30	1
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections- Nil

Figure 2: BGS Planetary Kp



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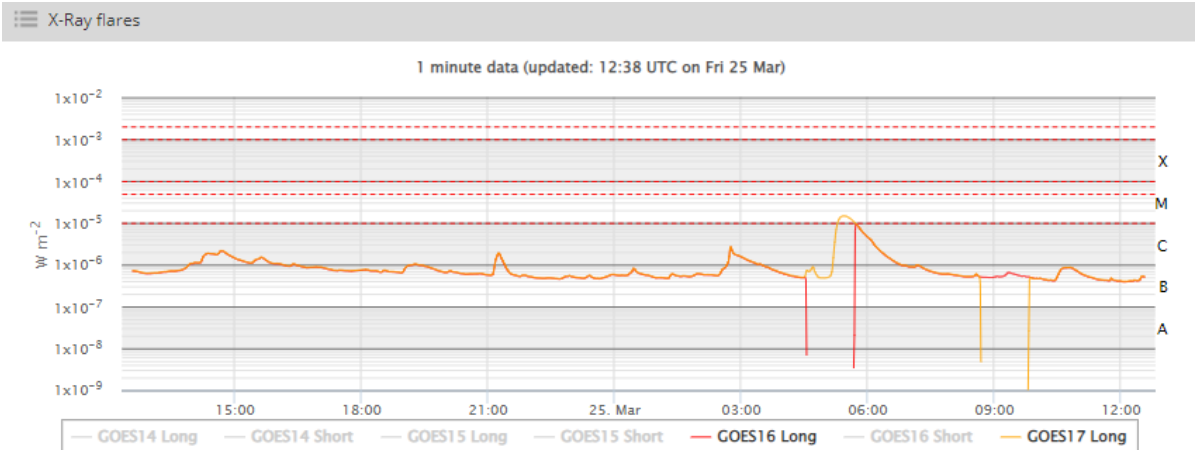
Radio Blackouts - X-Ray Flares:
There are three sunspot regions on the visible disc at time of issue. The largest is recently numbered AR2976 Ehi/Beta just to the east of a smaller region AR2975 Csi/beta, with some magnetic coupling suggested between the two regions on SDO imagery. Both regions have produced a number of C-flares. AR2974 produced an M1.46 flare at 25/0526 UTC, this region is a Cao/Beta. Through day 2 and into day 3 (26th-27th), a bright region on STEREO A EUVI, and also present on far-side analysis, is also expected to rotate onto the disc.
Solar Activity is expected to persist at Low levels, with a 30% chance of rising to Moderate.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	25	25	25	25
Very Active	R3 to R5 X Class	No	2	2	2	2

Figure 3: X-Ray flares- GOES 16 was in eclipse during the M flare, fortunately captured by GOES 17.



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Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (10MeV) measured at GOES-16 is expected to remain at Background levels throughout the forecast period. However, there is a slightly above background chance of an increase in observed proton flux, due to the potential growth of regions on the disk, as well as the possibility of a significant region rotating onto the visible disk either late day 2 or day 3 (26th or 27th).

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	2	2	2	2
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

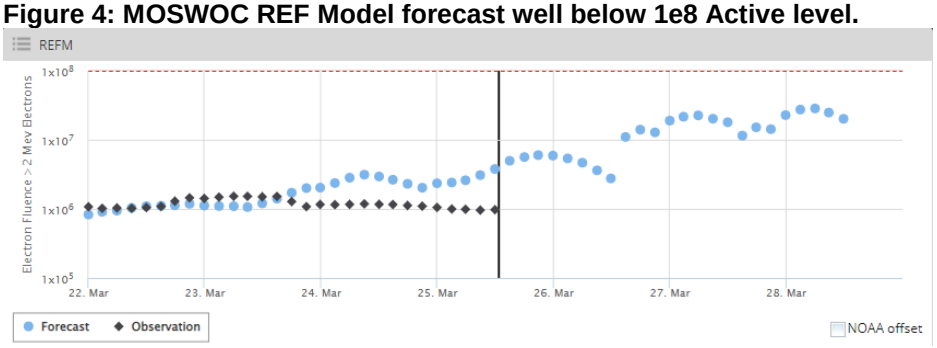
High Energy Electrons Event (≥ 2MeV):

The high energy (greater than 2 MeV) electron flux as observed by GOES-16 at GEO is currently at Background and likely to persist at these levels through to day 3 (27th), perhaps peaking at Moderate levels due to recent fast wind enhancement. A potential further rise in then likely due to the arrival of the fast wind of CH69. Moderate, possibly peaking at High flux likely day 4 (28th) however confidence is low.

The associated 24 hour fluence is expected to rise through the period, perhaps initially from recent fast wind enhancements, but more generally from any subsequent moderate to high flux from the fast wind of CH69. This bringing a chance of Active fluence by the end of the period. REFM is currently giving good guidance, with fluence remaining below the Active threshold, but with a potential slight rising trend.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ 2 MeV ≥ $1x10^8$	No	1	1	5	30
Very Active	≥ 2 MeV ≥ $1x10^9$	No	1	1	1	1

Figure 4: MOSWOC REF Model forecast well below 1e8 Active level.



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